

LISTING OF CLAIMS

For the Examiner's convenience, this Amendment includes the text of all claims under examination, a parenthetical expression for each claim to indicate the status of the claim, and markings to show changes relative to the immediate prior version of each currently amended claim. This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1 – 22 (Canceled).

Claim 23. (Currently amended): A reactor system for converting a tar sand ~~or a shale~~ feed into synthetic crude oil comprising:

- a) a fluidized bed reactor ~~including an oil shale or tar sand feed inlet~~
- b) said reactor having a feed inlet for a feed comprising a tar sand comprising a bitumen,
- c) said reactor having a fluidizing medium inlet for a gas comprising hydrogen,
- d) said reactor having a fluidized bed comprising said feed,
- e) said fluidized bed adapted for fluidization by said fluidizing medium,
- f) said reactor having an operating temperature about 1500°F or lower,
- g) said reactor having an outlet for a reactor product gas comprising a hydrocarbon,
- h) said reactor having an outlet for a solid
- ~~b) a feed introducing system connected to the feed inlet, wherein said feed introducing~~

~~system includes;~~

~~a sizing and screening device for reducing the feed to 1 inch or less size pieces and removing pieces greater than about 1 inch, while maintaining the feed at a temperature of less than about 100°F, and~~

~~a feeder device for introducing the reduced feed into the reactor.~~

Claim 24. (Currently Amended): The reactor system of claim 23, further comprising ~~wherein the fluidized bed reactor further includes:~~

~~a gas inlet for introducing a hydrogen mixture into said reactor; and~~

~~a product stream outlet for discharging a product stream from said reactor;~~

~~wherein the reactor system further comprises a hydrogen recycling system positioned connected between downstream of said gas outlet the product stream outlet and the gas inlet.~~

Claim 25. (Currently amended): The reactor system of claim 23 24, further comprising ~~wherein the fluidized bed reactor further includes:~~

~~a at least one separator at least partially located within said reactor and connected to said product stream outlet, wherein said separator which removes entrained solids from said reactor product gas stream as said stream discharges from the reactor and deposits said solids within said reactor, and~~

~~a spent solids outlet adjacent a top end of said reactor for discharging spent solids from said reactor.~~

Claim 26. (Currently amended): The reactor system of claim 25, having said separator comprising wherein the separator is a cyclone separator, and wherein the separating and purifying device includes a hot gas cleanup communicating with cyclone separator for separating fines entrained in the product stream discharged from the reactor.

Claim 27. (Currently amended): The reactor system of claim 23 24, further comprising wherein:

the feed inlet and the fluidizing medium inlet positioned for cocurrent flow of said bitumen and said gas comprising hydrogen through said fluidized bed

~~is adjacent a bottom end of the reactor and introduces the feed approximately horizontally into the reactor;~~

~~the gas inlet is adjacent a bottom end of the reactor, and~~

~~the product stream outlet is adjacent a top end of the reactor.~~

Claim 28. (Currently amended): The reactor system of claim 24, further comprising:
~~wherein the feed can react with hydrogen in the fluidized bed reactor at a desired temperature and pressure, wherein the said hydrogen recycling system comprising further includes;~~

~~a separating and purifying device for removing a substantially solids free hydrogen rich stream from the product stream;~~

a separating device for removing a portion of said hydrocarbon from said reactor product gas producing a gas comprising a recycle hydrogen,

~~to form~~ a recycle hydrogen gas stream,

a make-up hydrogen feed stream

a mixing device for admixing said recycle hydrogen and said make-up hydrogen feed ~~a fresh hydrogen stream with the recycle hydrogen stream~~ to form a hydrogen mixture,

a heater for heating at least said make-up hydrogen

~~, for heating a portion of said fresh hydrogen and recycle hydrogen streams to a temperature above the desired reaction temperature, and~~

a compressor for pressurizing at least the fresh make-up hydrogen and the recycle hydrogen ~~to a pressure above the desired reaction pressure.~~

Claim 29. (Currently amended): The reactor system of claim 23 ~~28~~, further comprising:

a heat exchanger to recover heat from a gas having a component which has exited said reactor

~~communicating with said hot gas cleanup for transferring heat from a product stream exiting the hot gas cleanup to a portion of a hydrogen mixture stream exiting the compressor.~~

Claim 30. (Currently amended): The reactor system of claim 23, 29 further comprising:

~~wherein the separating and purifying device includes a gas-liquid separator for separating a condensable hydrocarbon having exited the reactor as a reactor product gas~~
~~product stream exiting the heat exchanger into a synthetic crude oil product stream and a gas stream.~~

Claim 31. (Currently amended): The reactor system of claim 30, further comprising:
~~wherein the separating and purifying device includes a scrubbing system receiving a feed stream having a component which has exited said gas-liquid separator having an inlet connected to the gas-liquid separator, wherein the gas stream flows from the gas-liquid separator into the inlet of the scrubbing system, wherein the scrubbing system can remove impurities from the gas stream to produce a substantially pure hydrogen recycle stream.~~

Claim 32. (Currently amended): The reactor system of claim 23, 31 further comprising:

~~wherein the mixing device and the compressor are of unitary construction and comprise a compressor having a recycle hydrogen feed inlet connected to the scrubbing system and a fresh make-up hydrogen feed inlet connected to a fresh hydrogen source, wherein the recycle hydrogen stream can flow into the recycle hydrogen inlet and fresh hydrogen can flow into the fresh hydrogen inlet, and wherein the recycle hydrogen and the fresh hydrogen mix in the compressor~~

~~and are compressed to form a pressurized hydrogen mixture stream.~~

Claim 33. (Currently amended): The reactor system of claim 32, further comprising
~~wherein the said compressor having has a pressurized hydrogen mixture stream which provides a~~
~~feed component to a outlet connected to the heater via the heat exchanger, wherein the heater has~~
~~an outlet connected to the reactor, and wherein the hydrogen mixture stream can flow from the~~
~~compressor to the heat exchanger then to the heater, and then to the reactor.~~

Claim 34. (New): A reactor system for converting an oil shale into synthetic crude oil
comprising:

- a) a fluidized bed reactor,
- b) said reactor having a feed inlet for a feed comprising an oil shale comprising a
kerogen,
- c) said reactor having a fluidizing medium inlet for a gas comprising hydrogen,
- d) said reactor having a fluidized bed comprising said feed,
- e) said fluidized bed adapted for fluidization by said fluidizing medium,
- f) said reactor having an operating temperature about 1500°F or lower,
- g) said reactor having an outlet for a reactor product gas comprising a hydrocarbon,
- h) said reactor having an outlet for a solid.

Claim 35 (New): The reactor system according to either claim 23 or 34, further comprising:

a feed introducing system which provides said feed to said feed inlet with said feed comprising feed pieces having a dimension of about 1 inch or less.

Claim 36 (New): The reactor system according to claim 34, comprising a feed introducing system which comprises a device for separating pieces of feed material of a fluidizable size from pieces of feed having a size which is not fluidizable.

Claim 37 (New): The reactor system according to claim 35, comprising said feed introducing system comprising a screening device which removes pieces of said feed which have a dimension greater than about 1 inch from being fed to said reactor.

Claim 38 (New): The reactor system according to claim 34, comprising a feed introducing system comprising a device for modifying the size of feed particles to achieve a particle of a size which is fluidizable.

Claim 39 (New): The reactor system according to claim 23, comprising said feed introducing system which maintains said feed at a feed temperature of about 100°F or lower.

Claim 40. (New): The reactor system of claim 34, further comprising:
a hydrogen recycling system positioned downstream of said gas outlet.

Claim 41. (New): The reactor system of claim 34, further comprising:
a separator which removes entrained solids from said reactor product gas.

Claim 42. (New): The reactor system of claim 41, having said separator comprise a
cyclone.

Claim 43. (New): The reactor system of claim 34, further comprising:
the feed inlet and the fluidizing medium inlet positioned for cocurrent flow of said
kerogen and said gas comprising hydrogen through said fluidized bed.

Claim 44. (New): The reactor system of claim 40, further comprising:
said hydrogen recycling system comprising a separating device for removing a portion of
said hydrocarbon from said reactor product gas producing a gas comprising a recycle hydrogen,
a recycle hydrogen gas stream,
a make-up hydrogen feed stream
a mixing device for admixing said recycle hydrogen and said make-up hydrogen feed to
form a hydrogen mixture,
a heater for heating at least said make-up hydrogen, and

a compressor for pressurizing at least the make-up hydrogen.

Claim 45. (New): The reactor system of claim 34, further comprising:
a heat exchanger to recover heat from a gas having a component which has exited said reactor.

Claim 46. (New): The reactor system of claim 34, further comprising:
a gas-liquid separator for separating a condensable hydrocarbon having exited the reactor as a reactor product gas from a gas stream.

Claim 47. (New): The reactor system of claim 46, further comprising a scrubbing system receiving a feed stream having a component which has exited said gas-liquid separator.

Claim 48. (New): The reactor system of claim 34, further comprising:
a compressor having a recycle hydrogen feed and a make-up hydrogen feed.

Claim 49. (New): The reactor system of claim 48, further comprising:
said compressor having a hydrogen mixture stream which provides a feed component to a heater.

Claim 50. (New): A reactor system according to claim 23, further comprising
said feed comprising a tar sand having a piece size capable of passing through a one inch
mesh,
said fluidized bed comprising said feed and fluidized by said gas comprising hydrogen,
said reactor having an operating temperature of about 1000 °F or lower and an operating pressure
of 450 psi or greater,
said gas comprising hydrogen fed to said reactor at a temperature of about 1500 °F or
lower,
said reactor system adapted to recycle a gas comprising hydrogen,
said reactor system adapted for control of a methane level by having a gas purge.

Claim 51. (New): A reactor system according to claim 34, further comprising
said feed comprising an oil shale having a piece size capable of passing through a one
inch mesh,
said fluidized bed comprising said feed and fluidized by said gas comprising hydrogen,
said reactor having an operating temperature of about 1000 °F or lower and an operating pressure
of 450 psi or greater,
said gas comprising hydrogen fed to said reactor at a temperature of about 1500 °F or
lower,
said reactor system adapted to recycle a gas comprising hydrogen,
said reactor system adapted for control of a methane level by having a gas purge.

Claim 52. (New): The reactor system of claim 23, further comprising:
the feed inlet and the fluidizing medium inlet positioned for countercurrent flow of said bitumen and said gas comprising hydrogen through said fluidized bed.

Claim 53. (New): The reactor system of claim 34, further comprising:
the feed inlet and the fluidizing medium inlet positioned for countercurrent flow of said kerogen and said gas comprising hydrogen through said fluidized bed.

Claim 54. (New): The reactor system according to claim 34, comprising said feed introducing system which maintains said feed at a feed temperature of about 100°F or lower.